

What is claimed is:

1           1. A method for generating new tissue, the method  
2 comprising:

3           obtaining a liquid hydrogel-cell composition  
4 comprising a hydrogel and tissue precursor cells;  
5           delivering the liquid hydrogel-cell composition into  
6 a permeable, biocompatible support structure; and  
7           allowing the liquid hydrogel-cell composition to  
8 solidify within the support structure and the tissue  
9 precursor cells to grow and generate new tissue.

1           2. The method of claim 1, wherein the delivered  
2 liquid hydrogel-cell composition is injected into the  
3 support structure.

1           3. The method of claim 1, further comprising  
2 implanting the support structure into an animal.

1           4. The method of claim 3, wherein the hydrogel-cell  
2 composition is delivered after the support structure is  
3 implanted into an animal.

1           5. The method of claim 1, wherein the support  
2 structure comprises a ceramic material.

1           6. The method of claim 1, wherein the support  
2 structure is shaped in the form of desired tissue.

1           7. The method of claim 6, wherein the support  
2 structure is shaped in the form of articular cartilage  
3 adjacent a joint, a bone, a portion of a bone, or a bone  
4 defect.

1           8. The method of claim 6, wherein the support  
2 structure is shaped in the form of a cylinder having the  
3 diameter of the spinal cord of a mammal to be treated.

1           9. The method of claim 1, wherein the support  
2 structure is biodegradable.

1           10. The method of claim 1, wherein the support  
2 structure comprises a sponge or foam.

1           11. The method of claim 1, wherein the support  
2 structure is compressible.

1           12. The method of claim 1, wherein the support  
2 structure comprises a mesh of fibers.

1           13. The method of claim 1, wherein the support  
2 structure is rigid.

1           14. The method of claim 1, wherein the support  
2 structure is formed from polyanhydride, polyorthoester,  
3 polyglycolic acid, polylactic acid, or polyglactin.

1           15. The method of claim 1, wherein the support  
2 structure comprises porous hydroxyapatite.

1           16. The method of claim 1, wherein the hydrogel is  
2 selected from the group consisting of polysaccharides,  
3 proteins, polyphosphazenes, poly(oxyethylene) -  
4 poly(oxypropylene) block polymers, poly(oxyethylene) -  
5 poly(oxypropylene) block polymers of ethylene diamine,  
6 poly(acrylic acids), poly(methacrylic acids), copolymers of  
7 acrylic acid and methacrylic acid, poly(vinyl acetate), and  
8 sulfonated polymers.

1           17. The method of claim 1, wherein the tissue  
2 precursor cells are selected from the group consisting of  
3 epidermal cells, chondrocytes and other cells that form  
4 cartilage, macrophages, dermal cells, muscle cells, hair  
5 follicles, fibroblasts, organ cells, osteoblasts and other  
6 cells that form bone, endothelial cells, mucosal cells,  
7 pleural cells, ear canal cells, tympanic membrane cells,  
8 peritoneal cells, Schwann cells, corneal epithelial cells,  
9 gingiva cells, neural cells, neural stem cells, and tracheal  
10 epithelial cells.

1           18. The method of claim 1, wherein the tissue  
2 precursor cells are selected from the group consisting of  
3 central nervous system neural stem cells, autonomic nervous  
4 system neural stem cells, or peripheral nervous system  
5 neural stem cells.

1           19. The method of claim 1, wherein the tissue  
2 precursor cells are selected from the group consisting of  
3 brain stem cells and spinal cord stem cells.

1           20. The method of claim 1, wherein the tissue  
2 precursor cells are neuroendocrine stem cells.

1           21. The method of claim 1, wherein the tissue  
2 precursor cells are selected from the group consisting of  
3 bladder, small intestine, lung, heart, kidney, and liver  
4 autonomic neural stem cells.

1           22. A tissue forming structure comprising:  
2 a permeable, biocompatible support structure having  
3 a predetermined shape that corresponds to the shape of  
4 desired tissue; and  
5 a hydrogel-cell composition at least partially  
6 filling the support structure, wherein the hydrogel-cell  
7 composition comprises a hydrogel and tissue precursor cells.

1           23. The tissue forming structure of claim 22,  
2 wherein the hydrogel-cell composition is a solidified  
3 suspension of hydrogel supporting dispersed tissue precursor  
4 cells.

1           24. The tissue forming structure of claim 22,  
2 wherein the support structure comprises a ceramic material.

1           25. The tissue forming structure of claim 22,  
2 wherein the support structure is biodegradable.

1           26. The tissue forming structure of claim 22,  
2 wherein the support structure comprises a sponge or foam.

1           27. The tissue forming structure of claim 22,  
2 wherein the support structure is compressible.

1           28. The tissue forming structure of claim 22,  
2 wherein the support structure comprises a mesh of polymeric  
3 fibers.

1           29. The tissue forming structure of claim 22,  
2 wherein the support structure comprises a mesh of  
3 polyglycolic acid fibers and polylactic acid.

1           30. The tissue forming structure of claim 22,  
2 wherein the support structure is formed from polyanhydride,  
3 polyorthoester, polyglycolic acid, polylactic acid, or  
4 polyglactin.

1           31. The tissue forming structure of claim 22,  
2 wherein the support structure comprises porous  
3 hydroxyapatite.

1           32. The tissue forming structure of claim 22,  
2 wherein the support structure comprises metal.

1           33. The tissue forming structure of claim 22,  
2 wherein the support structure is rigid.

1           34. The tissue forming structure of claim 22,  
2 wherein the hydrogel is selected from the group consisting  
3 of polysaccharides, proteins, polyphosphazenes,  
4 poly(oxyethylene)-poly(oxypropylene) block polymers,  
5 poly(oxyethylene)-poly(oxypropylene) block polymers of  
6 ethylene diamine, poly(acrylic acids), poly(methacrylic  
7 acids), copolymers of acrylic acid and methacrylic acid,  
8 poly(vinyl acetate), and sulfonated polymers.

1           35. The tissue forming structure of claim 22,  
2 wherein the tissue precursor cells are selected from the  
3 group consisting of epidermal cells, chondrocytes and other  
4 cells that form cartilage, macrophages, dermal cells, muscle  
5 cells, hair follicles, fibroblasts, organ cells, osteoblasts  
6 and other cells that form bone, endothelial cells, mucosal  
7 cells, pleural cells, ear canal cells, tympanic membrane  
8 cells, peritoneal cells, Schwann cells, corneal epithelial  
9 cells, gingiva cells, neural cells, neural stem cells, and  
10 tracheal epithelial cells.

1           36. The tissue forming structure of claim 22,  
2 wherein the tissue precursor cells are selected from the  
3 group consisting of central nervous system neural stem  
4 cells, autonomic nervous system neural stem cells, or  
5 peripheral nervous system neural stem cells.

1           37. The tissue forming structure of claim 22,  
2 wherein the tissue precursor cells are selected from the  
3 group consisting of brain stem cells and spinal cord stem  
4 cells.

1           38. The tissue forming structure of claim 22,  
2 wherein the tissue precursor cells are neuroendocrine stem  
3 cells.

1           39. The tissue forming structure of claim 22,  
2 wherein the tissue precursor cells are selected from the  
3 group consisting of bladder, small intestine, lung, heart,  
4 kidney, and liver autonomic neural stem cells.

1           40. A tissue forming structure of claim 22, wherein  
2 the cells are bone forming cells and the support structure  
3 comprises porous hydroxyapatite.

1           41. An isolated, mammalian adult autonomic nervous  
2 system neural stem cell.

1           42. The isolated stem cell of claim 41, wherein the  
2 cell is isolated from heart, bladder, intestine, lung,  
3 liver, or kidney tissue.

1           43. An isolated, mammalian adult neuroendocrine  
2 stem cell.

1           44. A stem cell of claim 43, wherein the cell is  
2 isolated from adrenal gland or pancreas tissue.

1           45. A method of treating defective nervous tissue,  
2 the method comprising  
3           locating the physical boundaries of the defective  
4 tissue;  
5           removing the defective tissue to create a cavity and  
6 exposing healthy nervous tissue at the surfaces of the  
7 cavity;  
8           loading a hydrogel-neural stem cell composition into  
9 a support structure in the general size and shape of the  
10 cavity, wherein the neural stem cells are selected to  
11 differentiate into the healthy nervous tissue; and  
12           implanting the support structure into the cavity,  
13 thereby treating the defective nervous tissue.

1           46. The method of claim 45, wherein the defective  
2 nervous tissue is central nervous system tissue.

1           47. The method of claim 45, wherein the defective  
2 nervous tissue is in the brain.

1           48. The method of claim 45, wherein the defective  
2 nervous tissue is autonomic nervous system tissue.

1           49. The method of claim 45, wherein the defective  
2 nervous tissue is neuroendocrine tissue.

1           50. The method of claim 45, wherein the neural stem  
2 cells are isolated from the healthy nervous tissue.

1           51. The method of claim 45, wherein a spacer is  
2 implanted into the cavity temporarily, and is then replaced  
3 with the support structure.

1           52. The method of claim 45, wherein the hydrogel-  
2 neural stem cell composition is loaded into the support  
3 structure after the structure is implanted into the cavity.



1           53. A method of claim 45, wherein the defective  
2 nervous tissue is in the spinal cord, the method comprising  
3           locating the physical boundaries of the defective  
4 spinal cord tissue;  
5           removing the defective tissue to create a cavity and  
6 exposing healthy spinal cord tissue at the surfaces of the  
7 cavity;  
8           loading a hydrogel-spinal cord stem cell composition  
9 into a support structure in the general size and shape of  
10 the spinal cord cavity; and  
11           implanting the support structure into the spinal  
12 cord cavity, thereby treating the defective spinal cord  
13 tissue.